REMARKS

In the Official Action, the Examiner objected to the specification and required a substitute specification. In addition, the Examiner rejected claims 1 and 7 on various prior art grounds. In so doing, the Examiner took the position that the recitation of "prepared by suspension polymerization" was not given patentable weight.

In response to the points raised in the Action, applicants have provided a substitute specification which addresses the idiomatic English issues noted by the Examiner. The substitute specification contains no new matter. Sole independent claim 1 has been amended to define one aspect of the invention with greater precision by reciting the list of substances as being selected from the group consisting of carbon fiber, coke powder, graphite powder, bronze powder, and copper powder.

Before setting forth the reasons why the presently claimed invention is patentable over the cited prior art, applicants believe that an explanation of the invention and results which may be obtained therefrom is in order.

As currently recited in claim 1, one aspect of the invention provides a fluororesin molding composition which comprises 25-90% by weight of a tetrafluoroethylene polymer selected from the group consisting of a homopolymer of tetrafluoroethylene and a copolymer obtained by copolymerizing tetrafluoroethylene with copolymerizable monomers in an amount of not more than 1.0% by weight, prepared by suspension polymerization, 5-40% by weight of zinc oxide whisker and 2-40% by weight of granular filler having average particle size of not more than 200μm and/or fibrous filler having average fiber length of not more than 500μm which is at least one kind of substance selected from the group consisting of carbon fiber, coke powder, graphite powder, bronze powder, and copper powder, wherein the zinc oxide whisker contains tetrapod-shaped particles, and wherein the total amount of the tetrafluoroethylene polymer, the zinc oxide whisker and the filler is 100% by weight. has been extensively amended to define various aspects of the invention with greater precision.

As noted above, the Examiner has given no patentable weight to the term "prepared by suspension polymerization" in connection with the defined tetrafluoroethylene polymer. However, as set forth in MPEP § 2113, applicants have an opportunity to provide evidence that the recited process has an substantive effect on the resulting polymer. To this end, attached hereto is an excerpt from the "Fluororesin Handbook" edited by Takaomi Satokawa and printed by Nikkei Kogyo

Shinbunsha along with a partial English translation. This technical literature shows that the polymer prepared by suspension polymerization provides molding grade polymer powder whereas emulsion polymerization provides fine polymer grade or a polymer dispersion. In this respect, molding powder grade tetrafluoroethylene polymer has an average diameter of several mm to several cm and an irregular shape. Since the particles are hardly fibrillated and have a relatively high molecular weight, sliding parts obtained by molding such particles by compression or extrusion molding resist cracking. On the other hand, fine powder grade tetrafluoroethylene polymers have an average particle size of 300 to 600 μm and are prepared by coagulating and drying primary particles having an average diameter of 0.1 to 0.4 μm and have an oval shape. Such fine powder is easily fibrillated by a weak shearing force and thus molded articles prepared therefrom are easily cracked.

The difference between fine powder grade and molding powder grade is also recognized in the art, such as in the paragraph bridging columns 2 and 3 of Nakamaru et al., U.S. Patent No. 5,624,887, wherein the patent describes the use of fine PTFE polymer or a mixture of fine powder and molding powder. Accordingly, the recitation in claim 1 that the tetrafluoroethylene polymer is prepared by suspension polymerization must be considered in assessing the patentability of the claims of record.[1]

The claims of record further recite the presence of a specified amount of zinc oxide whisker which contains tetrapod-shaped particles and a defined amount of granular filler and/or fibrous filler of a specified size and type. In this latter respect, it is to be understood that the term "granular" filler is different from "spheroidal" filler. To illustrate this point, the Examiner's attention is respectfully directed to the attached copy of Japanese Standard JISZ 2500 "Powder Metallurgy Vocabulary". To provide a further understanding of the significance of this difference, also attached is a discussion of additional experimentation which shows that when one uses granular carbon, one can obtain superior wear resistance compared to a similar composition which use spheroidal carbon particles.

With the foregoing discussion and the claims of record and evidence in mind, applicants respectfully maintain that the claims of record are patentable over the cited

[1] It is also noted that in Abbott Laboratories v. Sandoz Inc., 566 F.3d 1282, 90 USPQ 2d 1769 (Fed. Cir. 2009) the Federal Circuit decided *en banc* that for an infringement analysis, the recited process steps must be considered in product-by-process claims.

documents. As discussed above, the present invention provides a composition that comprises recited amounts of a specific tetrafluoroethylene polymer, zinc oxide whisker and granular filler and/or fibrous filler and can attain substantially improved results compared to similar compositions that are not prepared in accordance with the teachings of the present invention. In particular, Oku, U.S. Patent No. 5,276,080, describes a static dissipative resin composition that includes semiconductor fillers dispersed in a resin. The resins are described in the passage beginning at column 9, line 53 and notably do not include a tetrafluoroethylene polymer. However, as described in the paragraph beginning at column 10, line 58, a solid lubricant such as polytetrafluoroethylene, as well as other types of lubricants can be included in the composition. To confirm the understanding that the resins used to principally form the composition do not include tetrafluoroethylene polymer, one can refer to the resins used in the Examples identified in column 12. Polytetrafluoroethylene is used as a solid lubricant in Examples 7 and 10 in an amount which is less than that recited in claim 1.

It is evident that Oku falls far short from being sufficient to anticipate claim 1 of the present application. The patent does not relate to a fluororesin molding composition, as recited in claim 1, as a tetrafluoroethylene polymer is not the primary resin, but is an optional component that is added as a lubricant. Even to the extent that the polytetrafluoroethylene is present, the few examples provide an amount that is less than recited in claim 1 and there is absolutely no description that the polytetrafluoroethylene be prepared by a suspension polymerization. Thus, when all these points are considered together, it is without question that Oku cannot be used as a basis for rejecting any of the amended claims.

The claims of record are also not anticipated or suggested by Shimasaki et al., U.S. Patent No. 5,498,654. This patent relates to a sliding bearing material containing at least two of aromatic polyester-resin particles, spherical carbon particles, and zinc-oxide whisker dispersed in a matrix consisting of polytetrafluoroethylene.

There is no teaching in Shimasaki et al. that the tetrafluoroethylene polymer be prepared by suspension polymerization and that the composition contains the defined granular or fibrous filler. In this respect, it will be noted that the patent describes the presence of spherical carbon particles as exemplified by Bellpearl C-2000 identified in the first paragraph of column 5 which is the material used in the comparative

experiment provided herewith and discussed above. Accordingly, Shimasaki et al. does not in any way negate the patentability of the presently claimed invention.

Yamamoto et al., U.S. Patent No. 5,988,891, also does not anticipate or suggest the presently claimed invention. The patent does not disclose that the fluororesin is prepared by suspension polymerization and does not describe the specific combination of the specific zinc oxide whiskers and the recited filler. In this last respect, it will be noted that one of the solid lubricants disclosed in the passage starting at column 4, line 33 that has been relied on by the Examiner is molybdenum disulfide which is no longer recited in claim 1. Thus, applicants again submit that the claims of record are patentable over Yamamoto et al.

Sato et al., U.S. Patent No. 6,675,770, relates to a pressing device for an apparatus for imparting a friction resistance to a rotary shaft driving and engine-output control device directly or indirectly to apply a resistance to an operation of an accelerator. A friction plate is also disclosed and is described as being formed of a fluorocarbon resin and at least one ingredient selected from a whisker whose Mohs hardness is 5 or less, a carbon fiber, and a hard resinous powder. The whiskers are described in the passage beginning at column 5, line 27 and spherical graphitized powders are described in the passage beginning at column 7, line 50. It will be noted that this passage includes the type of spherical carbon (Bellpearl C-2000) used in the comparative example provided herewith. Therefore, applicants respectfully maintain that Sato et al. also does not disclose or suggest the presently claimed fluororesin molding composition with the recited specific components and does not recognize the advantageous results which can be obtained therefrom.

Yoshinaka et al., U.S. Patent No. 5,183,594, relates to a conductive composition containing at least zinc oxide whiskers. As set forth in the paragraph beginning at column 12, line 38, the resin to be used in the composition can be either a thermoplastic or thermosetting resin selected from a lengthy list. It is evident from the resins provided in the Examples that Yoshinaka et al. would not lead those of ordinary skill in the art to the use of a tetrafluoroethylene polymer and certainly not one that is prepared by suspension polymerization. Moreover, of the various materials which can be added to the composition and which have been mentioned on page 4 of the Action, it will be noted that talc and glass fiber are no longer recited in claim 1. Thus, while applicants respectfully remain that one cannot selectively pick and choose from amongst the various teachings of Yoshinaka et al., even if one could,

the patent would still not lead to the invention as defined in the claims of record or an appreciation of the advantageous results which can be obtained therefrom.

Applicants similarly respectfully maintain that the claims of record are also patentable over Yoshinaka et al., U.S. Patent No. 5,310,598, which describes a radio wave absorbing material comprising zinc oxide whiskers. The patent does not specifically relate to a fluororesin molding composition as is clearly evident from the large variety of resins identified in the passage beginning at column 6, line 30 and the absence of examples which use a tetrafluoroethylene polymer. Moreover, the patent clearly does not describe a tetrafluoroethylene polymer prepared by suspension polymerization and there is no recognition that the recited combination of the tetrafluoroethylene polymer, the zinc oxide whiskers and the defined filler can provide the advantageous results illustrated in the evidence of record. In this respect, it is believed that an improvement in wear resistance would be of little, if any, interest for a radio wave absorbing material such as described in Yoshinaka et al.

For all of the reasons set forth above, applicants respectfully submit that the claims now of record are patentable over the cited prior art, particularly in view of the claims and evidence of record, and therefore request reconsideration and allowance of the present application.

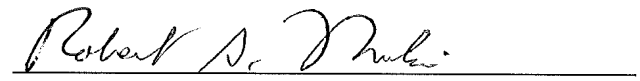
Should the Examiner have any questions concerning the subject application, the Examiner is invited to contact the undersigned attorney at the number provided below.

The Director is hereby authorized to charge any appropriate fees under 37 C.F.R. §§ 1.16, 1.17 and 1.20(d) and 1.21 that may be required by this paper, and to credit any overpayment, to Deposit Account No. 02-4800.

Respectfully submitted,

BUCHANAN INGERSOLL & ROONEY PC

Date: September 28, 2009

By: 

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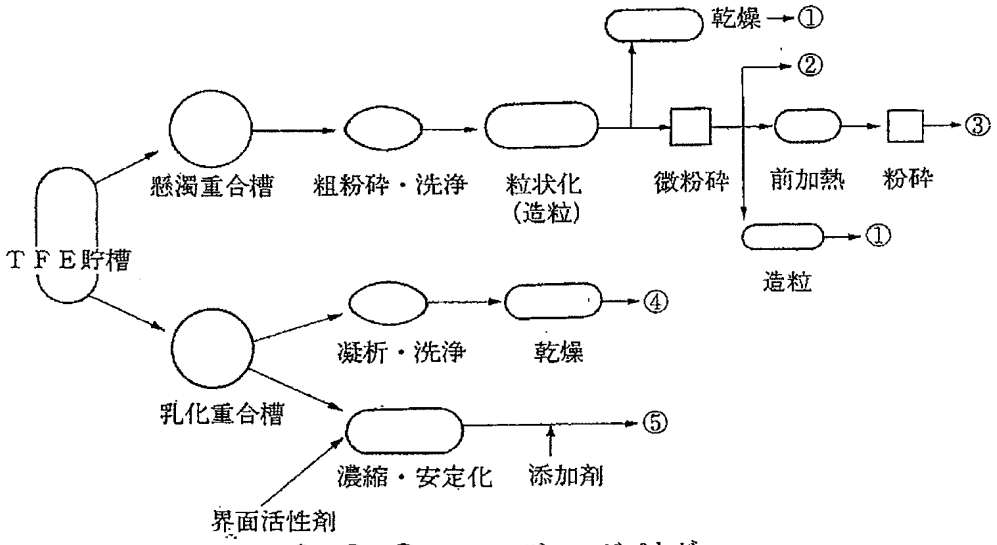
乳化重合では，固形分で約20～50%のポリマーラテックスが得られるが，ラテックス粒子は通常0.02～1.0 μmの広い分布を有し，平均粒径は反応条件によって異なるが0.1～0.4 μm程度である。しかし，通常のポリマーラテックスと異なって，重合結晶化のため形状に異方性を生じ，平均的には米粒に似た楕円体粒子である。微量乳化共重合した変性PTFEのラテックス粒子は球状に近い。

ラテックス粒子の物性，とりわけ粒径と形状は成形加工性に大きな影響を与える。例えば，ラテックス粒子を凝析してできるファインパウダーの押出成形圧力は(後述)，もとのラテックス粒子径との間に図II.1.2のような関係がある。

また，微量共重合を不均一に行ってCore-Shell構造をもたせた粒子も特長ある成形性を有する[23]。

1.1.3 成形用粉末・ディスパージョンの製造

懸濁重合や乳化重合で得られた粉末やラテックスは，それぞれの用途に応じて後処理が施され，成形用粉末・ディスパージョンとして市販される。図II.1.3に製造プロセスを示す。



①, ②, ③：モールディングパウダー
④：ファインパウダー
⑤：ディスパージョン

図II.1.3 PTFE成形用粉末・ディスパージョンの製造プロセス

Partial translation of page 29

1.1.3 Production of powders for molding and dispersion

Powders and latex produced by suspension polymerization and emulsion polymerization are post-treated for specific usage, and sold as powders for molding and dispersion. Production process is shown at Fig. II.1.3.

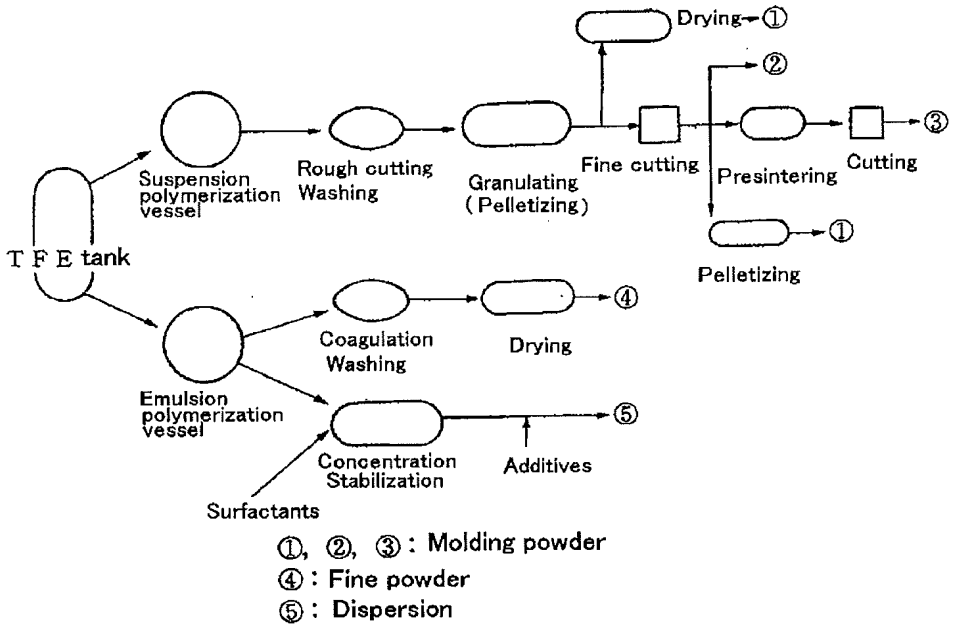


Fig. II.1.3 Production process of powders for molding - dispersion of PTFE

JAPANESE INDUSTRIAL STANDARD

Powder metallurgy—Vocabulary

JIS Z 2500 : 2000

Revised 2000-03-20

Investigated by

Japanese Industrial Standards Committee

Published by

Japanese Standards Association

定価：本体2,000円（税別）

ICS 01.040.77 ; 77.160

Descriptors : powder metallurgy, terminology, vocabulary

Reference number : JIS Z 2500 : 2000 (J)

番号	用語	定義	対応英語 (参考)
1310	ミリング	粉末の機械的処理に対する一般用語。 例 1. 粒子径又は形状の修正。(砕く，固めるなど) 2. よりよく混合する。 3. 他の成分で一つの成分粒子を被覆する。	milling
1311	造粒	流動性の改善を伴った粗い粉末を得るために微粉を凝集させる操作。	granulation
1312	スプレードライ	スラリの液滴から液相を急激に蒸発させることによって粉末を造粒する操作。	spray drying

4) 粉末の粒子形状

番号	用語	定義	対応英語 (参考)
1401	粒形	粉末粒子の外面的な幾何学的形態。	particle shape
1402	針状	針のような形状。(付図2参照)。	acicular
1403	角状	角張った形状又は粗い多面体の形状。(付図3参照)。	angular
1404	樹枝状	枝葉に分かれた形状。(付図4参照)。	dendritic
1405	繊維状	規則的又は不規則的に糸状になっている形状。(付図5参照)。	fibrous
1406	片状	板のような形状。(付図6参照)。	flaky, flaked
1407	粒状	不規則形状のものでなくほぼ等しい寸法をもつ形状。(付図7参照)。	granular
1408	不規則形状	対称性がない形状。(付図8参照)。	irregular
1409	涙滴状	丸みを帯びた不規則形状。(付図9参照)。	nodular
1410	球状	ほぼ球に近い形状。(付図10参照)。	spheroidal

5) 粉末の特性，試験方法，試験装置及び結果

番号	用語	定義	対応英語 (参考)
1501	安息角	水平面に自由に注いだときに粉末によって形成される山の底角。	angle of repose
1502	見掛密度	定められた条件下で得られた粉末の単位体積当たりの質量。 (JIS Z 2504参照)	apparent density
1503	バルク密度	定められていない条件下での粉末の単位体積当たりの質量。	bulk density
1504	タップ密度	振動させた容器内の粉末の単位体積当たりの質量。	tap density
1505	圧縮性	加えられた圧力下での粉末の緻密化されやすさ。通常ダイ内で単一軸に沿って加圧される。圧縮性は要求された密度に必要な圧力又は所定の圧力で得られた密度で表される。	compressibility
1506	成形性	粉末がある形状に成形され，その形状を保持する能力。成形性は流動性，圧縮性，圧粉体強さとの関係として表される。	compactibility
1507	ラトラ値	圧粉体をかごの中で繰り返し回転落下させ，その質量減少率で表す圧粉体のエッジ強さ。	rattler value
1508	圧縮比	充てんされた粉末の体積を圧粉体の体積で除した値。	compression ratio
1509	充てん比	充てんされた粉末の高さを圧粉体の高さで除した値。	fill factor
1510	流動性	空げきを通して流れる場合の粉末の挙動を表す用語。 (JIS Z 2502参照)	flowability

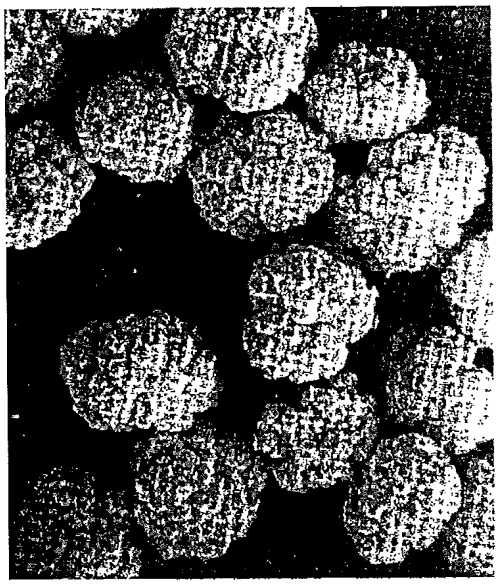
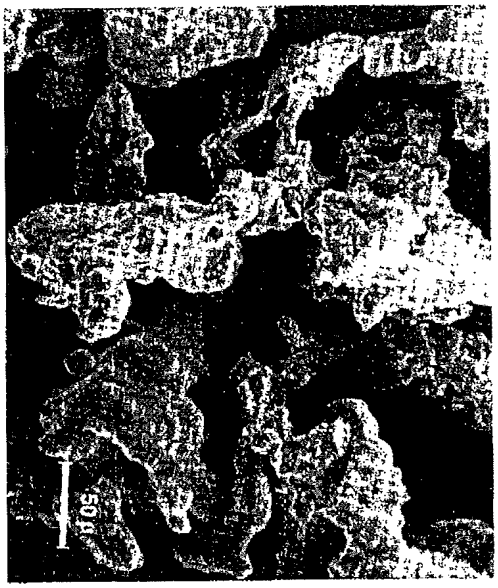
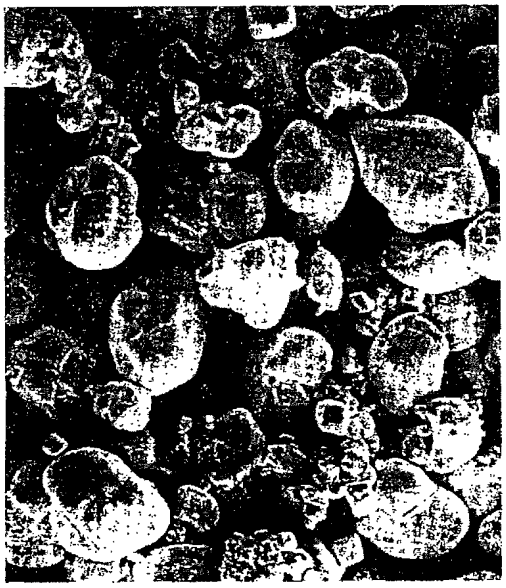


Fig. 7　付図7　粒状　Granular



付図8　不規則形状



付図9　涙滴状

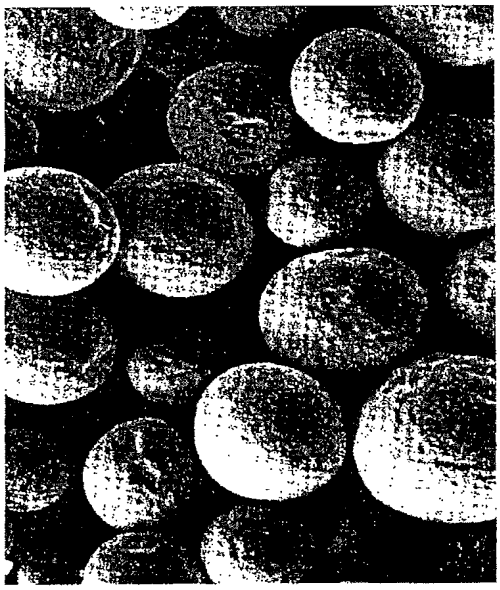


Fig. 10　付図10　球状　Spheroidal

Experimentation

1. Raw materials

(1) Tetrafluoroethylene homopolymer (PTFE)

Average particle size: 30-70μm, Specific gravity: 2.15-2.18

Product from DuPont· Mitsui Fluorochemicals Co, Ltd.

Grade name: Teflon (registered trade mark) 7F-1 Molding powder grade

(2) Zinc oxide whisker:

Diameter of a needle-shaped staple fiber 15-20μm,

Length of a needle-shaped staple fiber 2-50μm.

Product from Amtech Co., Ltd.

Trade name: Pana-Tetra WZ-0501

(3) Granular carbon

Average diameter 30.4μm, Specific gravity: 1.99-2.01

Product from Nippon Techno-Carbon Co. Ltd.

Trade name: NPC-3

(4) Spherical carbon

Average particle size 15-20μm, Specific gravity: 1.4-1.5

Product from Air Water Inc.

Trade name: Bellpearl C-2000

2. Preparation of fluororesin composition

The tetrafluoroethylene homopolymer, zinc oxide whisker and granular carbon or spherical carbon as listed above are mixed uniformly using Henschel mixer to obtain the resin compositions having the proportions described in Table I.

Each resin composition was preformed under pressure of 700MPa and then sintered at 370°C for three hours to obtain a cylinder-shaped molded article of a diameter of 50mm height of 100mm.

3. Measurement of wear coefficient

Wear coefficient of each resin composition was measured by the test methods mentioned below and the results are shown in Table 1.

A ring having outer diameter of 25.6mm, inner diameter of 20mm and height of 20mm is prepared from the cylinder-shaped molded article mentioned above and used as a specimen for the test.

Wear loss of the specimen was measured using twin type friction and wear tester (EFM-III-EN F-type product from Orientech Co. Ltd.) in accordance with JIS K7218 (A method). Measurement of wear loss was conducted by sliding for 24 hours under each wear test conditions of the partner material of ADC-12 which is an aluminum alloy die-casting, a load of 8kg/cm2, and a sliding speed of 0.5m/sec. After the test the wear coefficient is calculated from the wear loss.

After measurement was conducted once, the test surface was carved off to create fresh surface for the following measurement. The measurement was repeated.

Results are shown in Table I

		Test order	Granular carbon		Spherical carbon	
Composition (wt%)	Fluororesin		75	70	75	70
	Carbon		15	20	15	20
	Whisker		10	10	10	10
Specific gravity			2.233	2.219	2.126	2.076
Wear coefficient ($x10^6$) ($cm^3 \cdot sec/kg \cdot m \cdot Hr$)		1	14.9	8.0	28.1	8.9
		2	12.2	11.8	92.2	400
		3	14.5	9.2	19.2	15.4
		4	28.9	9.3	14.5	369
		Average	17.6	9.3	71.1	198.3

4. Conclusion

As clear from the results of Table 1, the fluororesin composition containing the granular carbon particles shows lower wear coefficients than the fluororesin composition containing the spherical carbon particles.

This better result of the fluororesin composition containing the granular carbon particles may be caused from that the granular carbon particle is hardly

detached from the sliding surface because it has greater surface area and better attached strength to the fluororesin. On the other hand, it seems that since the spherical carbon particle is more easily detached from the sliding surface, the wear coefficient is larger and not stable.